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IMPROVED REPOSITION CLUSTER HEAD IN LEACH PROTOCOL FOR HETEROGENEOUS WIRELESS NETWORK

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ABSTRACT

With the fast improvement in wireless technologies, amenities and devices, used in a distinct radio system, in which second generation (2G) and third-generation (3G) wireless scheme may be not effective to transmit data with great speed and services related to quality for end users in a best-connected way. The futuristic wireless methods (Heterogeneous Wireless Network (HWN)) are being formulated with the image of heterogeneity, where a mobile end user may be effectively accessed multiple wireless networks. In this work, we propose the integrated network of cluster-based Adhoc network with a cellular network. This scheme also provides repositioning of the CH with the nodes. The new CH selection will improve network parameters like throughput, energy consumption, stability and configuration time. We design developed and implemented using NS-2.

KEYWORDS: Cluster Head (Ch), Heterogeneous Wireless Network (Hwn), Leach, Mobility Management & Ns-2

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Original Article

INTRODUCTION

From the survey, it has been concluded that utilization of wireless systems becomes the part of our daily routine life. However, different wireless techniques are sophistically used globally through diverse position so that, users can utilize properly and custom internet seamlessly [1, 2]. Hence, the heterogeneous network must offer ubiquitous communication competency and statistics access irrespective of a user's position. There are numerous radio terminals used with respect to the necessities and the features of systems, among them may be categorized with respect to their coverage area and data rate. The WLAN or Wi-Fi function at different data rates for their forward link and reverse link data communication. The dynamism of WLAN has a different effect such as reconfiguration [3]. A regular 3G cellular network has a different area of coverage with the data speed of 200-300 kbps or more. However, the Mobile Ad-hoc Network (MANET) is one more radio communication network without infrastructure [4, 5]. It is described by different topology with mobility provision to the node with narrow bandwidth. Every mobile node will function as both host and router. It sends a data signal to different nodes by one-to-one approach [6].

We design and develop an integrated network, in which it incorporates 3G network and MANET. It extracts the features of the area coverage from the 3G structure and the more data rate in Mobile Ad-hoc network. We also analyze the mobility management to provide seamless mobility. For this, we considered the cluster based Leach algorithm for Ad-hoc network, where CH is moved then entire cluster becomes unused. So we define the

new CH in such a way that it has been repositioned (reconfigured) with same old CH position, so that parameters like throughput, energy consumption and stability should be improved, and we also calculate the settling time (reconfiguration time) for the new node where it is joining the new cluster.

RELATED WORK

In Clustering technique, mobile nodes of network system arrange themselves into hierarchical structures [3, 7]. Using clustering, mobile nodes can use the limited network resources such as bandwidth, battery energy efficiently. In the individual cluster, aggregation of data and fusion are done by the head of a cluster to decrease the quantity of data forwarding to the earth-based station. Cluster creation is usually performed based on a residual energy of nodes, stability and selection of cluster-head [1]. Normal nodes select their CH right after employment and transmit data to the CH. The function of CH is to send its personal data and external files from different nodes to the fixed-base station after doing fusion and combination of data. LEACH is unique among the hierarchical protocols intended for routing in radio networks. The scheme proposed in LEACH has encouraged many other protocols.

In no paper, they are discussing about the movement of CH itself from the cluster. But in our proposed scheme we considered the movement of CH and its effect of the network parameters.

PROPOSED WORK

The proposed heterogeneous radio network, integrates the feature of the mobile network and MANET infrastructure less networks. In the work, we are proposed that consists of Hetnet design, that utilizing node mobility applications. The previous existing works did not concentrate on the dynamism of CH. Many different factors are considering in cell network such as channel availability, node stability, reduction in interference and efficiency that need to be reflected in improving the performance of routing for transferring reliable data.

In this scheme we consider the cluster based LEACH algorithm. There is two ways of communication exist. One intra-cluster data communication and another inter-cluster data transmission. The network parameters like throughput, delay and jitter have very much differed in these two networks. The LEACH protocol has two parts: one Set-Up phase and second Steady-State phase.

The first step – In which CH selected.

The Second-Step – In which CH is maintained when data is transmitted between nodes.

Selection of CH in MANET

Initially, the selection of CH is done according to the normal LEACH algorithm i.e. based on an energy level parameter. The proposed method helps in saving energy by only assigning chosen CH to converse with other CHs or Base station. All remaining nodes except CH are in sleep mode, so their energy is saved. CH will act as both node and router of that cluster. But in our proposed work we considered the mobility of CH. That is if CH itself will be moved from home cluster to another cluster, then how the network will work.

Mobility of CH

If the CH of the cluster is moved out of the cluster, then that cluster will be loose communication ability. And we have to choose new CH in such a way that it will provide maximum throughput and minimum delay with keeping

high stability. So we selected new CH based on the energy level and reposition i.e. old CH place, so that we achieve maximum improved network parameters.

The CHs obtained with this method will not be close to each other. The threshold value is r (n):

Γ (n) = p/1-p ×(r mod p-1).

Where each node n produces a random figure such that 0< figure < 1 and matches it to a well-defined threshold r (n). If generated figure < r (n), now that node will be CH in that round, otherwise it is a normal mobile node.

Stability Factor

The salient features of proposed network are it maintains the stability of the network.

We are motivated to calculate the zone dist.(Zd) from one node ni to all the set of its neighbors.

$Zd(n_i) = \sum$ zone dist(n_i, n_j)

We calculate the stability factor for each node ni as

$SF(n_i)= Zd(n_i)/deg(n_i)$

Node with higher stability factor is considered for good candidates to be selected as cluster head (CH).

WORKING SCENARIO

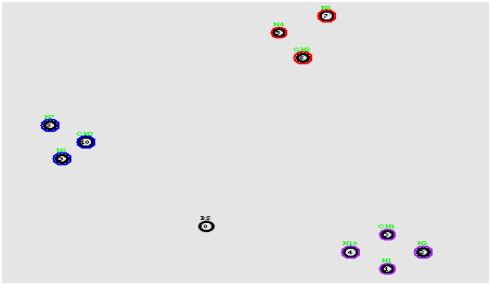

Figure 1: Initial 3 Clusters in Networks.

Figure 1 represents that 3 clusters are considered in the network topology and the node having maximum energy level appoints as CH of their cluster formed.

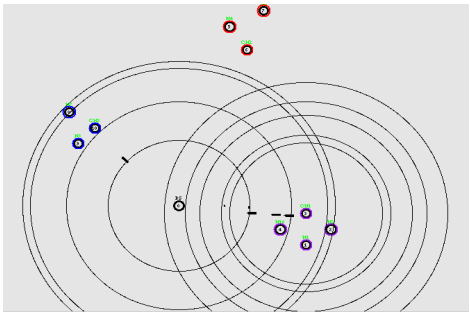

Figure 2: Inter-Cluster Communication.

Above figure 2 demonstrates, inter-cluster scenario, this is transmission between two CH of different clusters will be considered through Base station, which gives less throughput and more delay, compared to intracluster communication.

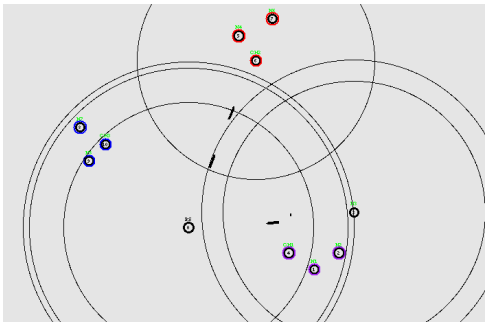

Figure 3: Inter-Cluster Communication

Above Figure 3 shows about CH movement. In which CH is moving as node away from the cluster and that node will be communicating to the different cluster through Base station.

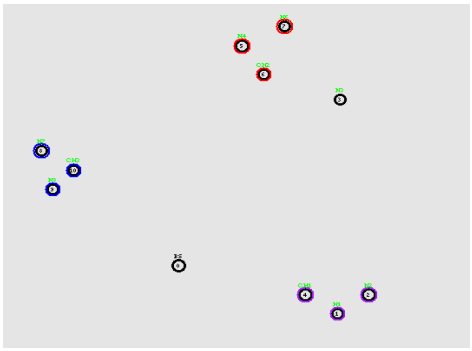

Figure 4: CH as a Node Join New Cluster.

Above figure 4 shows CH is moving towards another cluster as a node and joins the new cluster and after joining it takes minimum time to reconfigure.

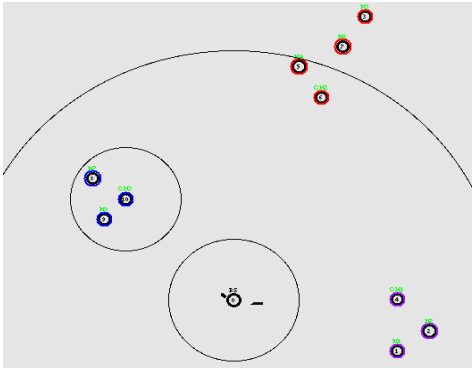

Figure 5: Inter-Cluster Communication Through New CH

Above figure 5 shows, after CH movement, the CH of the cluster is chosen based on maximum node stability factor and energy level and new CH is repositioned to an old CH place and its communication to other clusters, which will give better throughput and less delay.

SIMULATION RESULTS

In this criteria, the simulation is carried for two scenarios such as with CH movement and without CH movement. The simulation is done using NS2.

Table 1: Parameters of Simulation

Parameter	Value
Space of Simulation	300x300
Number of nodes	10
Wireless Model	Two way model
Antenna	Omni-direction
Model of Energy	Energy model
Channel Type	Wireless
Simulation Time	160

RESULTS

The following are results noted using tcl, tr and awk files of NS2.

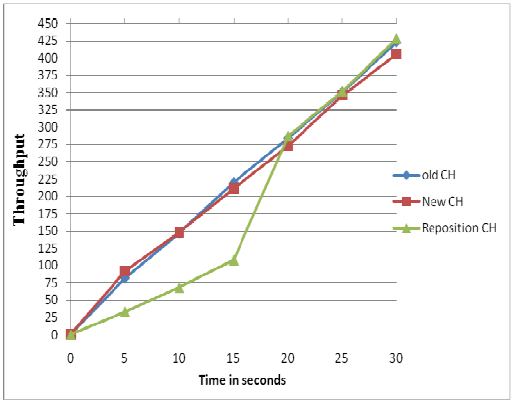

Figure 6: Total Throughput of Network

In figure 6 it is seen that the dynamism of clusters adopted in the algorithm has better throughput than others other two algorithms. The reposition can be scaled and adapted to have better throughput.

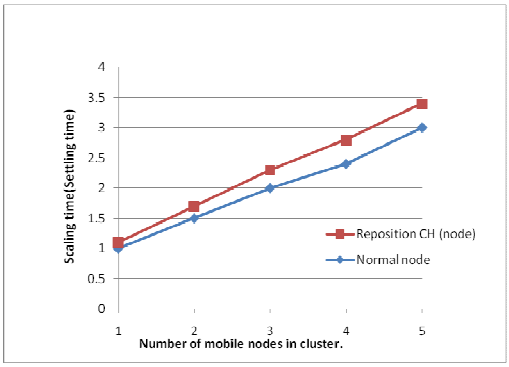

Figure 7: Configuration Time.(Settling Time)

The Figure 7 shows the effect of the dynamism of CH on configuration time. When CH moves from the network needs to reconfigure which is very high in other algorithm compare to our work.

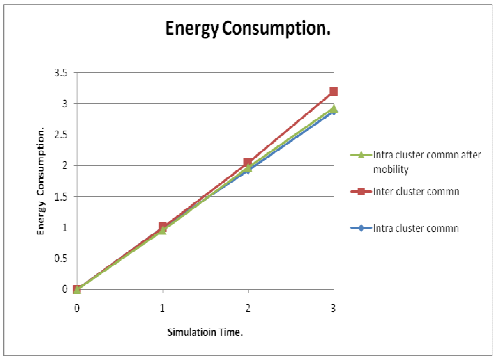

Figure 8: Energy Consumed in the Network

In Figure 8 shows a graph for energy consumption of the network for the different instant of simulation time. The new CH of the cluster is chosen based on maximum node stability factor and energy level and CH is repositioned to old CH place and its communication to other clusters, which will provide throughput and less delay.

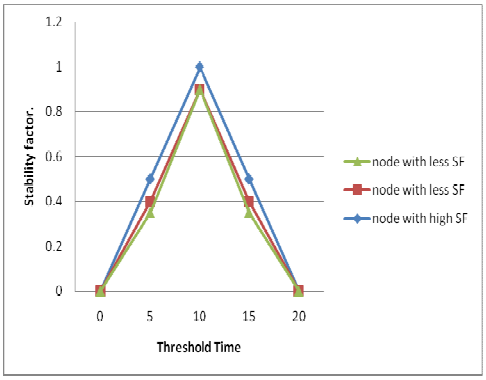

Figure 9: Stability of the Node

In figure 9 explain about the stability of the moving node. We calculated stability with respect to mobility. As time increases from an initial time to threshold time then if the stability of the node increases from minimum to maximum then that node should be considered for selecting as CH.

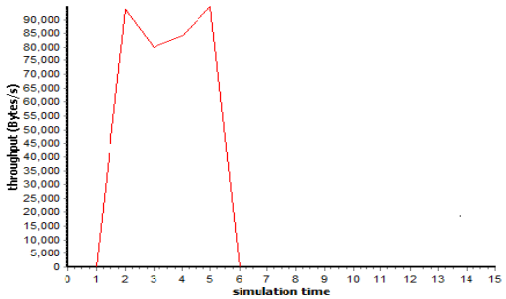

Figure 10: Intra-Cluster throughput

Above Figure 10 shows about throughput of a node in intracluster node communication, in which it generates more number of packets (90000).

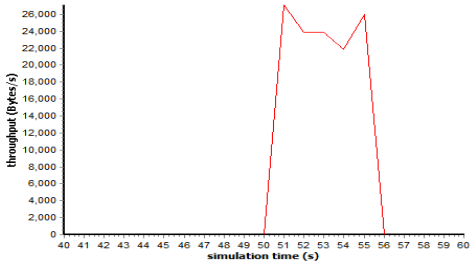

Figure 11: Inter-Cluster throughput

In Figure 11 shows about the throughput of node in inter-cluster node communication, in which it generates less number of packets (26000).

CONCLUSIONS

In this proposed work, we have constructed a heterogeneous wireless network comprise of Mobile Ad-hocnetwork and 3G mobile network. The contribution of this work is to examine the throughput, stability, configuration delay, energy consumption and performance analysis of LEACHprotocol by means of a desired set of parameters. This work has also analyzed the movement of the CH in the network and how it will affect the network parameter, which is shown in our simulation results. The result also improves the throughput of the network, minimize the configuration time and enhance in the overall efficiency of the proposed network. From the view of future research direction, work is clear to fulfill the issues presented by parameters such as fault tolerance, topology-change, rate, scalability, and energy consumption for Ad-hoc systems.

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